CLAIMS

I CLAIM:

1. A spectroscopic rotating compensator material system investigation system comprising a source of a polychromatic beam of electromagnetic radiation, a polarizer, a stage for supporting a material system, an analyzer, a dispersive optics and at least one detector system which contains a multiplicity of detector elements, said spectroscopic rotating compensator material system investigation system further comprising at least one pseudo-achromatic compensator(s) positioned at a location selected from the group consisting of:

> before said stage for supporting a material system;
>
> after said stage for supporting a material system; and
>
> both before and after said stage for supporting a material system;

there being in the path of a polychromatic beam of electromagnetic radiation, provided by said source thereof, at least four apertures between said source of polychromatic beam of electromagnetic radiation and said stage for supporting a material system, and at least three apertures between said stage for supporting a material system and said at least one detector system;

such that when said spectroscopic rotating compensator

material system investigation system is used to investigate a material system present on said stage for supporting a material system, said analyzer and polarizer are maintained essentially fixed in position and at least one of said at least one compensator(s) is caused to continuously rotate while a polychromatic beam of electromagnetic radiation produced by said source of a polychromatic beam of electromagnetic radiation is caused to pass through said polarizer and said at least one compensator(s) and said at least four apertures between said source of polychromatic beam of electromagnetic radiation and said stage for supporting a material system, said polychromatic beam of electromagnetic radiation being also caused to interact with a material system on said stage for supporting a material system, pass through said analyzer and said at least three apertures between said stage for supporting a material system, and interact with said dispersive optics such that a multiplicity of essentially single wavelengths are caused to simultaneously enter a corresponding multiplicity of detector elements in said at least one detector system.

2. A spectroscopic rotating compensator material system investigation system comprising a source of a polychromatic beam of electromagnetic radiation, a first aperture, a second aperture, a fixed polarizer, a rotating compensator, a third aperture, a forth aperture, a first substantally achromatic lens, a fifth aperture, a stage for supporting a material system, a sixth aperture, a second substantally achromatic lens, a seventh aperture, an eighth aperture, a fixed analyzer, a ninth aperture, a third substantially achromatic lens, an optical fiber and at least one detector system which comprises a dispersive element and a multiplicity of detector elements, there further being a UV filter present between said source of a polychromatic beam of electromagnetic radiation and said stage for supporting a

material system;

such that when said spectroscopic rotating compensator material system investigation system is used to investigate a material system present on said stage for supporting a material system, said fixed analyzer and fixed polarizer are maintained essentially fixed in position and said rotating ompensator is caused to continuously rotate while a polychromatic beam of electromagnetic radiation produced by said source of a polychromatic beam of electromagnetic radiation is sequentially caused to pass through said first aperture, second aperture, fixed polarizer, rotating compensator, third aperture, forth aperture, first substantally achromatic lens, fifth aperture, said polychromatic beam of electromagnetic radiation also passing through said UV filter, then interact with a material system placed on said stage for supporting a material system, then sequentially pass through said sixth aperture, second substantally achromatic lens, seventh aperture, eighth aperture, fixed analyzer, ninth aperture, third substantially achromatic lens, enter said optical fiber and therevia enter said detector system.

3. A spectroscopic rotating compensator material system investigation system as in Claim 2, in which the rotating compensator comprises a selection from the group consisting of:

comprised of a combination of at least two zero-order waveplates, said zero-order waveplates and having their respective fast axes rotated to a position offset from zero or ninety degrees with respect to one another;

comprised of a combination of at least a first and a second effective zero-order wave plate, said first effective zero-order wave plate being comprised of two multiple order

waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, and said second effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another; the fast axes of the multiple order waveplates in said second effective zero-order wave plate being rotated to a position at a nominal forty-five degrees to the fast axes of the multiple order waveplates and in said first effective zero-order waveplate;

comprised of a combination of at least a first and a second effective zero-order wave plate, said first effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, and said second effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another; the fast axes of the multiple order waveplates in said second effective zero-order wave plate being rotated to a position away from zero or ninety degrees with respect to the fast axes of the multiple order waveplates and in said first effective zero-order waveplate; and

comprised of a combination of at least one zero-order waveplate and at least one effective zero-order waveplate, said effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, the fast axes of the multiple order waveplates in said effective zero-order wave plate being rotated to a position away from zero or ninety degrees with respect to the fast axis of the zero-order waveplate.

4. A spectroscopic rotating compensator material system investigation system as in Claim 2, in which:

said first aperture is a pin-hole, through which a portion of the polychromatic beam of electromagnetic radiation passes, with a nominal internal diameter of between 100 and 600 microns;

said second aperture through which a portion of the polychromatic beam of electromagnetic radiation passes, has a nominal internal diameter has a nominal internal diameter of 3 to 3.5 millimeters;

said third aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 3.5 millimeters;

said forth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 3.75 millimeters;

said fifth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 4.8 millimeters;

said sixth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 4.8 millimeters;

said seventh aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 3.75 millimeters;

an eighth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 3.5 millimeters;

said ninth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has an adjustible internal diameter;

5. A spectroscopic rotating compensator material system investigation system as in Claim 2, which further comprises, between said source of polychromatic beam of electromagnetic radiation and said stage for supporting a material system, a UV filter to prevent UV wavelengths from accessing a material system placed on said stage for supporting a material system.

6. A spectroscopic rotating compensator material system investigation system as in Claim 2 which further comprises, between said fixed polarizer and said ninth aperture, a beam splitting means which serves to divert a portion of the polychromatic beam of electromagnetic radiation which otherwise proceeds to said optical fiber, and transmits the remainder of said polychromatic beam of electromagnetic radiation theretoward, said diverted portion of said polychromatic beam of electromagnetic radiation being directed by said beam splitting means into an alignment means selected from the group consisting of:

reticule; and

electromagnetic beam detecting means;

such that in use said alignment means provides monitored alignment capability thereby allowing precise control of the locus of propagation of the portion of said polychromatic beam of electromagnetic radiation which transmits through said beam splitting means.

7. A spectroscopic rotating compensator material system investigation system as in Claim 6, in which is present said electromagnetic beam detecting means in functional combination with electronic circuitry means which which serves to automatically align said portion of said polychromatic beam of electromagnetic radiation which is transmitted toward said ninth aperture and optical fiber.

8. A spectroscopic rotating compensator material system investigation system as in Claim 2 in which dispersive optics and detector elements are contained in an off-the-shelf diode array spectrometer system.

9. A spectroscopic rotating compensator material system investigation system as in Claim 8 in which said detector system which comprises a dispersive optics and multiplicity of detector elements comprises an off-the-shelf diode array spectrometer system provides an operational wavelength range selected from the group consisting of:

300-1150 nm;
190-730 nm;
190-400 nm; and
900-2400 nm;

and optionally includes a detector which demonstrates a quantum efficiency of at least greater than forty (40%) percent.

10. A spectroscopic rotating compensator material system investigation system as in Claim 2 in which rotating compensator provides that retardation effected thereby between orthogonal components of a beam of electromagnetic radiation at one wavelength is different than that provided thereby at at least one other wavelength.

11. A spectroscopic rotating compensator material system investigation system as in Claim 2 in which the compensator provides retardance within a range of thirty (30.0) to less than one-hundred-thirty-five (135) degrees over a range of wavelengths defined by a selection from the group consisting of:

a) minimum wavelength is less than/equal to one-hundred-ninety (190) and maximum wavelength greater than/equal to seventeen-hundred (1700) nanometers;

b) minimum wavelength is less than/equal to two-hundred-twenty (220) and maximum wavelength MAXW greater than/equal to one-thousand (1000) nanometers;

c) within a range of wavelengths defined by a maximum wavelength (MAXW) and a minimum wavelength (MINW) range where (MAXW)/(MINW) is at least four-and-one-half (4.5);

or said compensator provides retardance within a range of seventy-five (75.0) to less than one-hundred-thirty-five (135) degrees over a range of wavelengths defined by a selection from

the group consisting of:

a) between one-hundred-ninety (190) and seven-hundred-fifty (750) nanometers;

b) between two-hundred-forty-five (245) and nine-hundred (900) nanometers;

c) between three-hundred-eighty (380) and seventeen-hundred (1700) nanometers;

d) within a range of wavelengths defined by a maximum wavelength (MAXW) and a minimum wavelength (MINW) wherein the ratio of (MAXW)/(MINW) is at least one-and-eight-tenths.

12. A spectroscopic rotating compensator material system investigation system as in Claim 2 in which the compensator provides that retardation effected thereby between orthogonal components of a beam of electromagnetic radiation at one wavelength is essentially the same as that provided thereby at other wavelengths.

13. A spectroscopic rotating compensator material system investigation system as in Claim 2 in which the compensator causes essentially no deviation or displacement in a polychromatic beam of electromagnetic radiation caused to pass therethrough while caused to rotate.

14. A spectroscopic rotating compensator material system investigation system as in Claim 2 in which the compensator is of a type selected from the group consisting of:

Berek-type with optical axis essentially

perependicular to a surface thereof;

non-Berek-type with an optical axis essentially parallel to a surface thereof;

zero-order wave plate;

zero-order waveplate constructed from two multiple order waveplates;

a sequential plurality of zero-order waveplates, each constructed each from a plurality of multiple order waveplates;

rhomb;

polymer;

achromatic crystal; and

pseudo-achromatic.

15. A spectroscopic rotating compensator material system investigation system as in Claim 2, in which the dispersive optics is a diffraction grating.

16. A spectroscopic rotating compensator material system investigation system as in claim 15 in which said diffraction grating is selected from the group consisting of:

a "lined";
a "blazed"; and
a "holographic" geometry;

said lined geometry consisting essentially of symetrical alternating lines with depressions therebetween, and said blazed geometry consisting of alternating ramp shaped lines with depressions therebetween, and said holographic geometry consisting of continuous cosine shaped lines and depressions.

17. A spectroscopic rotating compensator material system investigation system as in Claim 2, in which the dispersive optics comprises a prism.

18. A spectroscopic rotating compensator material system investigation system as in Claim 2 in which said fiber optic present after said analyzer becomes at least bifrucated thereby providing a plurality of fiber optic bundles, at least two of which plurality of at least two bifrucated fiber optic bundles provide input to separate detector system), each of said separate detector systems comprising a dispersion optics and a multiplicity of detector elements, said plurality of fiber optic bundles having cross-sectional shapes at ends thereof selected from the group:

essentially circular;

essentially slit shaped;

other than essentially circular; and

essentially slit shaped.

19. A spectroscopic rotating compensator material system investigation system as in Claim 1 which is characterized by a mathematical model comprising calibration parameters, at least one of which is a member of the group consisting of:

effective polarizer azimuthal angle orientation (Ps);

present material system PSI (ψ), as a function of angle of incidence and a thickness;

present material system DELTA (Δ), as a function of angle of incidence and a thickness;

compensator azimuthal angle orientation (C_s);

matrix components of said compensator;

analyzer azimuthal angle orientation (A_s); and

detector element image persistance (x_n) and read-out (p_n) nonidealities;

which mathematical model is effectively a transfer function which enables calculation of electromagnetic beam magnitude as a function of wavelength detected by a detector element (DE), given magnitude as a function of wavelength provided by said source of polychromatic beam of electromagnetic radiation (EPCLB); said calibration parameter(s) selected from the group consisting of:

effective polarizer azimuthal angle orientation (Ps);

present material system PSI (ψ), as a function of angle of incidence and a thickness;

present material system DELTA (Δ), as a function of angle of incidence and a thickness;

compensator azimuthal angle orientation;

matrix components of said compensator (C_s) as a function of wavelength;

analyzer azimuthal angle orientation (A_s); and

detector element image persistance (x_n) and read-out (p_n) nonidealities;

being, in use, evaluated by performance of a mathematical regression of said mathematical model onto at least one, multi-dimensional, data set(s), said at least one, multi-dimensional, data set(s) being magnitude values vs. wavelength and a at least one parameter selected from the group consisting of:

angle-of-incidence of said polychromatic beam of electromagnetic radiation with respect to a present material system (MS); and

effective or actual azimuthal angle rotation of one element selected from the group consisting of:

said polarizer (P); and

said analyzer (A);

obtained over time, while said compensator (C) is caused to continuously rotate;

said at least one, multi-dimensional, data set(s) each being normalized to a selection from the group consisting of:

a data set D.C. component;

a data set A.C. component;

a parameter derived from a combinations of a data set D.C. component and a data set A.C. component.

20. A spectroscopic rotating compensator material system investigation system as in Claim 2 which is characterized by a mathematical model comprising calibration parameters, at least one of which is a member of the group consisting of:

effective polarizer azimuthal angle orientation (Ps);

present material system PSI (ψ), as a function of angle of incidence and a thickness;

present material system DELTA (Δ), as a function of angle of incidence and a thickness;

compensator azimuthal angle orientation (C_s);

matrix components of said compensator;

analyzer azimuthal angle orientation (A_s); and

detector element image persistance (x_n) and read-out (p_n) nonidealities;

which mathematical model is effectively a transfer function which enables calculation of electromagnetic beam magnitude as a function of wavelength detected by a detector element (DE), given magnitude as a function of wavelength provided by said source of polychromatic beam of electromagnetic radiation (EPCLB); said calibration parameter(s) selected from the group consisting of:

effective polarizer azimuthal angle orientation (Ps);

present material system PSI (ψ), as a function of angle of incidence and a thickness;

present material system DELTA (Δ), as a function of angle of incidence and a thickness;

compensator azimuthal angle orientation;

matrix components of said compensator (C_s) as a function of wavelength;

analyzer azimuthal angle orientation (A_s); and

detector element image persistance (x_n) and read-out (p_n) nonidealities;

being, in use, evaluated by performance of a mathematical regression of said mathematical model onto at least one, multi-dimensional, data set(s), said at least one, multi-dimensional, data set(s) being magnitude values vs. wavelength and a at least one parameter selected from the group consisting of:

angle-of-incidence of said polychromatic beam of electromagnetic radiation with respect to a present material system (MS); and

effective or actual azimuthal angle rotation of one element selected from the group consisting of:

said polarizer (P); and

said analyzer (A);

obtained over time, while said compensator (C) is caused to continuously rotate;

said at least one, multi-dimensional, data set(s) each being normalized to a selection from the group consisting of:

a data set D.C. component;

a data set A.C. component;

a parameter derived from a combinations

of a data set D.C. component and a data set A.C. component.

21. A spectroscopic rotating compensator material system investigation system as in Claim 1 which further comprises an environmental control chamber in which is present said spectroscopic rotating compensator material system investigation system, said environmental control chamber is characterized by a selection from the group consisting of:

it comprises at least one chamber region in which is present polarization state generator comprising component(s) prior to said material system, said material system, and polarization state detector comprising component(s) after said material system;

it comprises at least three chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, in the second of which is present the material system and in the third of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system and said material system, and in the second of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, and in the second of which is present polarization state detector comprising component(s) after said material system and said material system.

22. A spectroscopic rotating compensator material system investigation system as in Claim 2 which further comprises an environmental control chamber in which is present said spectroscopic rotating compensator material system investigation system, said environmental control chamber is characterized by a selection from the group consisting of:

it comprises at least one chamber region in which is present polarization state generator comprising component(s) prior to said material system, said material system, and polarization state detector comprising component(s) after said material system;

it comprises at least three chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, in the second of which is present the material system and in the third of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system and said material system, and in the second of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, and in the second of which is present polarization state detector comprising component(s) after said material system and said material system.

23. A spectroscopic rotating compensator material system investigation system comprising a source of a polychromatic beam of electromagnetic radiation, a first aperture, a second aperture, a fixed polarizer, a rotating compensator, a third aperture, a forth aperture, a first substantally achromatic lens, a fifth aperture, a stage for supporting a material system, a sixth aperture, a second substantally achromatic lens, a seventh aperture, an eighth aperture, a fixed analyzer, a ninth aperture, a third substantially achromatic lens, an optical fiber and at least one detector system which comprises a dispersive element and a multiplicity of detector elements, there further being a UV filter present between said source of a polychromatic beam of electromagnetic radiation and said stage for supporting a material system;

such that when said spectroscopic rotating compensator material system investigation system is used to investigate a material system present on said stage for supporting a material system, said fixed analyzer and fixed polarizer are maintained essentially fixed in position and said rotating ompensator is caused to continuously rotate while a polychromatic beam of electromagnetic radiation produced by said source of an polychromatic beam of electromagnetic radiation is sequentially caused to pass through said first aperture, second aperture, fixed polarizer, rotating compensator, third aperture, forth aperture, first substantally achromatic lens, fifth aperture, said polychromatic beam of electromagnetic radiation also passing through said UV filter, then interact with a material system placed on said stage for supporting a material system, then sequentially pass through said sixth aperture, second substantally achromatic lens, seventh aperture, eighth aperture, fixed analyzer, ninth aperture, third substantially achromatic lens, enter said optical fiber and therevia enter said detector system;

wherein said spectroscopic rotating compensator material system investigation system:

said first aperture is a pin-hole, through which a portion of the polychromatic beam of electromagnetic radiation passes, with a nominal internal diameter of between 100 and 600 microns;

said second aperture through which a portion of the polychromatic beam of electromagnetic radiation passes, has a nominal internal diameter has a nominal internal diameter of 3 to 3.5 millimeters;

said third aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 3.5 millimeters;

said forth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 3.75 millimeters;

said fifth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 4.8 millimeters;

said sixth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 4.8 millimeters;

said seventh aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 3.75 millimeters;

an eighth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has a nominal internal diameter of 3.5 millimeters;

said ninth aperture, through which a portion of the polychromatic beam of electromagnetic radiation passes, has an internal diameter has an adjustible internal diameter;

and wherein said spectroscopic rotating compensator material system investigation system said rotating compensator comprises a selection from the group consisting of:

comprised of a combination of at least two zero-order waveplates, said zero-order waveplates and having their respective fast axes rotated to a position offset from zero or ninety degrees with respect to one another;

comprised of a combination of at least a first and a second effective zero-order wave plate, said first effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, and said second effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another; the fast axes of the multiple order waveplates in said second effective zero-order wave plate being rotated to a position at a nominal forty-five degrees to the fast axes

of the multiple order waveplates and in said first effective zero-order waveplate;

comprised of a combination of at least a first and a second effective zero-order wave plate, said first effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, and said second effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another; the fast axes of the multiple order waveplates in said second effective zero-order wave plate being rotated to a position away from zero or ninety degrees with respect to the fast axes of the multiple order waveplates and in said first effective zero-order waveplate; and

comprised of a combination of at least one zero-order waveplate and at least one effective zero-order waveplate, said effective zero-order wave plate being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, the fast axes of the multiple order waveplates in said effective zero-order wave plate being rotated to a position away from zero or ninety degrees with respect to the fast axis of the zero-order waveplate;

said compensator causing essentially no deviation or displacement in a polychromatic beam of electromagnetic radiation caused to pass therethrough while caused to rotate;

said compensator providing retardance within a range of thirty (30.0) to less than one-hundred-thirty-five (135)

degrees over a range of wavelengths defined by a selection from the group consisting of:

a) minimum wavelength is less than/equal to one-hundred-ninety (190) and maximum wavelength greater than/equal to seventeen-hundred (1700) nanometers;

b) minimum wavelength is less than/equal to two-hundred-twenty (220) and maximum wavelength MAXW greater than/equal to one-thousand (1000) nanometers;

c) within a range of wavelengths defined by a maximum wavelength (MAXW) and a minimum wavelength (MINW) range where (MAXW)/(MINW) is at least four-and-one-half (4.5);

or said compensator provides retardance within a range of seventy-five (75.0) to less than one-hundred-thirty-five (135) degrees over a range of wavelengths defined by a selection from the group consisting of:

a) between one-hundred-ninety (190) and seven-hundred-fifty (750) nanometers;

b) between two-hundred-forty-five (245) and nine-hundred (900) nanometers;

c) between three-hundred-eighty (380) and seventeen-hundred (1700) nanometers;

d) within a range of wavelengths defined by a maximum wavelength (MAXW) and a minimum wavelength (MINW) wherein the ratio of

(MAXW)/(MINW) is at least one-and-eight-tenths;

said spectroscopic rotating compensator material system investigation system further comprising, between said fixed polarizer and said ninth aperture, a beam splitting means which serves to divert a portion of the polychromatic beam of electromagnetic radiation which otherwise proceeds to said optical fiber, and transmits the remainder of said polychromatic beam of electromagnetic radiation theretoward, said diverted portion of said polychromatic beam of electromagnetic radiation being directed by said beam splitting means into an alignment means selected from the group consisting of:

reticule; and

electromagnetic beam detecting means;

such that in use said alignment means provides monitored alignment capability thereby allowing precise control of the locus of propagation of the portion of said polychromatic beam of electromagnetic radiation which transmits through said beam splitting means.

24. A spectroscopic rotating compensator material system investigation system as in Claim 23 which further comprises an environmental control chamber in which is present said spectroscopic rotating compensator material system investigation system, said environmental control chamber being characterized by a selection from the group consisting of:

it comprises one chamber region in which is present a polarization state generator comprising components prior to said material system, said material system, and a

polarization state detector comprising components after said materials system;

it comprises three chamber regions, in one of which is present a polarization state generator comprising all components prior to said material system, in the second of which is present the material system and in the third of which is present a polarization state detector comprising components after said materials system;

it comprises two chamber regions, in one of which is present a polarization state generator comprising components prior to said material system and said material system, and in the second of which is present a polarization state detector comprising components after said materials system;

it comprises two chamber regions, in one of which is present a polarization state generator comprising components prior to said material system, and in the second of which is present a polarization state detector comprising components after said materials system and said material system.

25. A spectroscopic rotating compensator material system investigation system as in Claim 1, wherein the source of an polychromatic beam of electromagnetic radiation provides ultraviolet wavelength electromagnetic radiation and comprises:

a chamber which comprises an enclosed space;

a source lamp which when electrically energized produces ultraviolet wavelength electromagnetic radiation, said source lamp being present in said enclosed space, said chamber having means for allowing produced ultraviolet radiation to exit as a collimated beam;

means for providing electrical potential to said source lamp;

heat transfer means which is situated to accept heat from said source lamp and conduct it to outside said enclosed space to a heat sink;

gas flow production means for causing a flow of gas over said heat sink;

such that in use voltage is applied to said lamp source by said means for providing electrical potential to said source lamp; and heat and ultraviolet wavelength electromagnetic radiation and ozone are produced thereby, at least some of said heat being conducted by said heat transfer means to said heat sink whereat it is disipated by a gas flow therearound produced by said gas flow production means, while simultaneously at least some of said ultraviolet wavelength electromagnetic radiation is caused to exit said means for allowing produced ultraviolet radiation to exit as a collimated beam, while produced ozone is contained within said enclosed space.

26. A spectroscopic rotating compensator material system investigation system as in Claim 25 which further comprises a polarizer in the pathway of said collimatd beam of electromagnetic radiation, said polarizer being selected from the group consisting of:

Calcite;
BBO;
MgFl;

to impose a state of substantially linear polarization thereupon in wavelength ranges between 1100nm and:

245nm;
220nm; and
193nm;

respectively.

27. A spectroscopic rotating compensator material system investigation system as in Claim 25 in which the means for allowing produced ultraviolet radiation to exit as a collimated beam comprises a pin hole and lens means present inside a protective tube which serves to prevent air flow by said lens means.

28. A spectroscopic rotating compensator material system investigation system as in Claim 25 in which the source lamp is a Xenon bulb, the voltage applied thereto is about 20KV and wherein said Xenon Lamp temperature rises to about 200 degrees C, the heat sink to about 65 degrees C, and the exterior of said chamber to no more than about 50 degrees C during use.

29. A spectroscopic rotating compensator material system investigation system comprising a source of an polychromatic beam of electromagnetic radiation, a polarizer, a stage for supporting a material system, an analyzer, a dispersive optics and at least one detector system which comprises a multiplicity of detector elements, said spectroscopic rotating compensator material system investigation system further comprising at least one ~~pseudo-achromatic~~ compensator(s) positioned at a location selected from the group consisting of:

before said stage for supporting a material system;

after said stage for supporting a material system; and

both before and after said stage for supporting a material system;

there being in the path of a polychromatic beam of electromagnetic radiation, provided by said source thereof, at least one aperture between said source of polychromatic beam of electromagnetic radiation and said stage for supporting a material system, and at least one aperture between said stage for supporting a material system and said at least one detector system;

such that when said spectroscopic rotating compensator material system investigation system is used to investigate a material system present on said stage for supporting a material system, said analyzer and polarizer are maintained essentially fixed in position and at least one of said at least one compensator(s) is caused to continuously rotate while a polychromatic beam of electromagnetic radiation produced by said source of a polychromatic beam of electromagnetic radiation is caused to pass through said polarizer and said at least one compensator(s) and said at least one aperture between said source of polychromatic beam of electromagnetic radiation and said stage for supporting a material system, said polychromatic beam of electromagnetic radiation being also caused to interact with a material system on said stage for supporting a material system, pass through said analyzer and said at least one aperture between said stage for supporting a material system, and interact with said dispersive optics such that a multiplicity of essentially single wavelengths are caused to simultaneously enter a corresponding multiplicity of detector elements in said at least one detector system;

said spectroscopic rotating compensator material system investigation system further comprising an environmental control chamber in which said spectroscopic rotating compensator material system investigation system is contained, said environmental control chamber being characterized by a selection from the group consisting of:

it comprises at least one chamber region in which is present polarization state generator comprising component(s) prior to said material system, said material system, and polarization state detector comprising component(s) after said material system;

it comprises at least three chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, in the second of which is present the material system and in the third of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system and said material system, and in the second of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, and in the second of which is present polarization state detector comprising component(s) after said material system and said material system.

30. A spectroscopic ellipsometer system as in Claim 29, in which

at least one pseudo-achromatic compensator(s) comprises a single element.

31. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises at least two per se. zero-order waveplates (MOA) and (MOB), said per se. zero-order waveplates (MOA) and (MOB) having their respective fast axes rotated to a position offset from zero or ninety degrees with respect to one another, with a nominal value being forty-five degrees.

32. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises a combination of at least a first (ZO1) and a second (ZO2) effective zero-order wave plate, said first (ZO1) effective zero-order wave plate being comprised of two multiple order waveplates (MOA1) and (MOB1) which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, and said second (ZO2) effective zero-order wave plate being comprised of two multiple order waveplates (MOA2) and (MOB2) which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another; the fast axes (FAA2) and (FAB2) of the multiple order waveplates (MOA2) and (MOB2) in said second effective zero-order wave plate (ZO2) being rotated to a position at a nominal forty-five degrees to the fast axes (FAA1) and (FAB1), respectively, of the multiple order waveplates (MOA1) and (MOB1) in said first effective zero-order waveplate (ZO1).

33. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises at least a first (ZO1) and a second (ZO2) effective zero-order wave plate, said first (ZO1) effective zero-order wave plate being comprised of two multiple order waveplates (MOA1) and (MOB1)

which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, and said second (ZO2) effective zero-order wave plate being comprised of two multiple order waveplates (MOA2) and (MOB2) which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another; the fast axes (FAA2) and (FAB2) of the multiple order waveplates (MOA2) and (MOB2) in said second effective zero-order wave plate (ZO2) being rotated to a position away from zero or ninety degrees with respect to the fast axes (FAA1) and (FAB1), respectively, of the multiple order waveplates (MOA1) and (MOB1) in said first effective zero-order waveplate (ZO1).

34. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises at least one zero-order waveplate, ((MOA) or (MOB)), and at least one effective zero-order waveplate, ((ZO2) or (ZO1) respectively), said effective zero-order wave plate, ((ZO2) or (ZO1)), being comprised of two multiple order waveplates which are combined with the fast axes thereof oriented at a nominal ninety degrees to one another, the fast axes of the multiple order waveplates in said effective zero-order wave plate, ((ZO2) or (ZO1)), being rotated to a position away from zero or ninety degrees with respect to the fast axis of the zero-order waveplate, ((MOA) or (MOB)).

35. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises a first triangular shaped element, which as viewed in side elevation presents with first and second sides which project to the left and right and downward from an upper point, which first triangular shaped element first and second sides have reflective outer surfaces; said retarder system further comprising a second triangular shaped element which as viewed in side elevation

presents with first and second sides which project to the left and right and downward from an upper point, said second triangular shaped element being made of material which provides reflective interfaces on first and second sides inside thereof; said second triangular shaped element being oriented with respect to the first triangular shaped element such that the upper point of said second triangular shaped element is oriented essentially vertically directly above the upper point of said first triangular shaped element; such that in use an input electromagnetic beam of radiation caused to approach one of said first and second sides of said first triangular shaped element along an essentially horizontally oriented locus, is caused to externally reflect from an outer surface thereof and travel along a locus which is essentially upwardly vertically oriented, then enter said second triangular shaped element and essentially totally internally reflect from one of said first and second sides thereof, then proceed along an essentially horizontal locus and essentially totally internally reflect from the other of said first and second sides and proceed along an essentially downward vertically oriented locus, then externally reflect from the other of said first and second sides of said first triangular shaped elements and proceed along an essentially horizontally oriented locus which is undeviated and undisplaced from the essentially horizontally oriented locus of said input beam of essentially horizontally oriented electromagnetic radiation; with a result being that retardation is entered between orthogonal components of said input electromagnetic beam of radiation.

36. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises, as viewed in upright side elevation, first and second orientation adjustable mirrored elements which each have reflective surfaces; said compensator system further comprising a third element which, as viewed in upright side elevation, presents with first and

second sides which project to the left and right and downward from an upper point, said third element being made of material which provides reflective interfaces on first and second sides inside thereof; said third element being oriented with respect to said first and second orientation adjustable mirrored elements such that in use an input electromagnetic beam of radiation caused to approach one of said first and second orientation adjustable mirrored elements along an essentially horizontally oriented locus, is caused to externally reflect therefrom and travel along a locus which is essentially upwardly vertically oriented, then enter said third element and essentially totally internally reflect from one of said first and second sides thereof, then proceed along an essentially horizontal locus and essentially totally internally reflect from the other of said first and second sides and proceed along an essentially downward vertically oriented locus, then reflect from the other of said first and second orientation adjustable mirrored elements and proceed along an essentially horizontally oriented propagation direction locus which is essentially undeviated and undisplaced from the essentially horizontally oriented propagation direction locus of said input beam of essentially horizontally oriented electromagnetic radiation; with a result being that retardation is entered between orthogonal components of said input electromagnetic beam of radiation.

37. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises a parallelogram shaped element which, as viewed in side elevation, has top and bottom sides parallel to one another, both said top and bottom sides being oriented essentially horizontally, said retarder system also having right and left sides parallel to one another, both said right and left sides being oriented at an angle to horizontal, said retarder being made of a material with an index of refraction greater than that of a surrounding

ambient; such that in use an input beam of electromagnetic radiation caused to enter a side of said retarder selected from the group consisting of:

right and left;

along an essentially horizontally oriented locus, is caused to diffracted inside said retarder system and follow a locus which causes it to essentially totally internally reflect from internal interfaces of both said top and bottom sides, and emerge from said retarder system from a side selected from the group consisting of

left and right respectively;

along an essentially horizontally oriented locus which is undeviated and undisplaced from the essentially horizontally oriented locus of said input beam of essentially horizontally oriented electromagnetic radiation; with a result being that retardation is entered between orthogonal components of said input electromagnetic beam of radiation.

38. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises first and second triangular shaped elements, said first triangular shaped element, as viewed in side elevation, presenting with first and second sides which project to the left and right and downward from an upper point, said first triangular shaped element further comprising a third side which is oriented essentially horizontally and which is continuous with, and present below said first and second sides; and said second triangular shaped element, as viewed in side elevation, presenting with first and second sides which project to the left and right and upward from an upper point, said second triangular shaped element further

comprising a third side which is oriented essentially horizontally and which is continuous with, and present above said first and second sides; said first and second triangular shaped elements being positioned so that a rightmost side of one of said first and second triangular shaped elements is in contact with a leftmost side of the other of said first and second triangular shaped elements over at least a portion of the lengths thereof; said first and second triangular shaped elements each being made of material with an index of refraction greater than that of a surrounding ambient; such that in use an input beam of electromagnetic radiation caused to enter a side of a triangular shaped element selected from the group consisting of:

first and second;

not in contact with said other triangular shape element, is caused to diffracted inside said retarder and follow a locus which causes it to essentially totally internally reflect from internal interfaces of said third sides of each of said first and second triangular shaped elements, and emerge from a side of said triangular shaped element selected from the group consisting of:

second and first;

not in contact with said other triangular shape element, along an essentially horizontally oriented locus which is undeviated and undisplaced from the essentially horizontally oriented locus of said input beam of essentially horizontally oriented electromagnetic radiation; with a result being that retardation is entered between orthogonal components of said input electromagnetic beam of radiation.

39. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises a

triangular shaped element, which as viewed in side elevation presents with first and second sides which project to the left and right and downward from an upper point, said retarder system further comprising a third side which is oriented essentially horizontally and which is continuous with, and present below said first and second sides; said retarder system being made of a material with an index of refraction greater than that of a surrounding ambient; such that in use a an input beam of electromagnetic radiation caused to enter a side of said retarder system selected from the group consisting of:

first and second;

along an essentially horizontally oriented locus, is caused to diffracted inside said retarder system and follow a locus which causes it to essentially totally internally reflect from internal interface of said third sides, and emerge from said retarder from a side selected from the group consisting of

second and first respectively;

along an essentially horizontally oriented locus which is undeviated and undisplaced from the essentially horizontally oriented locus of said input beam of essentially horizontally oriented electromagnetic radiation; with a result being that retardation is entered between orthogonal components of said input electromagnetic beam of radiation.

40. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises first and second Berek-type retarders which each have an optical axes essentially perpendicular to a surface thereof, each of which first and second Berek-type retarders has a fast axis, said fast axes in said first and second Berek-type retarders being oriented

in an orientation selected from the group consisting of:

parallel to one another; and
other than parallel to one another;

said first and second Berek-type retarders each presenting with first and second essentially parallel sides, and said first and second Berek-type retarders being oriented, as viewed in side elevation, with first and second sides of one Berek-type retarder being oriented other than parallel to first and second sides of the other Berek-type retarder; such that in use an incident beam of electromagnetic radiation is caused to impinge upon one of said first and second Berek-type retarders on one side thereof, partially transmit therethrough then impinge upon the second Berek-type retarder, on one side thereof, and partially transmit therethrough such that a polarized beam of electromagnetic radiation passing through both of said first and second Berek-type retarders emerges from the second thereof in a polarized state with a phase angle between orthogonal components therein which is different than that in the incident beam of electromagnetic radiation, and in a propagation direction which is essentially undeviated and undisplaced from the incident beam of electromagnetic radiation; with a result being that retardation is entered between orthogonal components of said input electromagnetic beam of radiation.

41. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises first and second Berek-type retarders which each have an optical axes essentially perpendicular to a surface thereof, each of which first and second Berek-type retarders has a fast axis, said fast axes in said first and second Berek-type retarders being oriented other than parallel to one another; said first and second

Berek-type retarders each presenting with first and second essentially parallel sides, and said first and second Berek-type retarders being oriented, as viewed in side elevation, with first and second sides of one Berek-type retarder being oriented other than parallel to first and second sides of the other Berek-type retarder; such that in use an incident beam of electromagnetic radiation is caused to impinge upon one of said first and second Berek-type retarders on one side thereof, partially transmit therethrough then impinge upon the second Berek-type retarder, on one side thereof, and partially transmit therethrough such that a polarized beam of electromagnetic radiation passing through both of said first and second Berek-type retarders emerges from the second thereof in a polarized state with a phase angle between orthogonal components therein which is different than that in the incident beam of electromagnetic radiation, and in a propagation direction which is essentially undeviated and undisplaced from the incident beam of electromagnetic radiation, said compensator system further comprising third and forth Berek-type retarders which each have an optical axes essentially perpendicular to a surface thereof, each of which third and forth Berek-type retarders has a fast axis, said fast axes in said third and forth Berek-type retarders being oriented other than parallel to one another, said third and forth Berek-type retarders each presenting with first and second essentially parallel sides, and said third and forth Berek-type retarders being oriented, as viewed in side elevation, with first and second sides of one of said third and forth Berek-type retarders being oriented other than parallel to first and second sides of said forth Berek-type retarder; such that in use an incident beam of electromagnetic radiation exiting said second Berek-type retarder is caused to impinge upon said third Berek-type retarder on one side thereof, partially transmit therethrough then impinge upon said forth Berek-type retarder on one side thereof, and partially transmit therethrough such that a polarized beam of

electromagnetic radiation passing through said first, second, third and forth Berek-type retarders emerges from the forth thereof in a polarized state with a phase angle between orthogonal components therein which is different than that in the incident beam of electromagnetic radiation caused to impinge upon the first side of said first Berek-type retarder, and in a direction which is essentially undeviated and undisplaced from said incident beam of electromagnetic radiation; with a result being that retardation is entered between orthogonal components of said input electromagnetic beam of radiation.

42. A spectroscopic ellipsometer system as in Claim 29, in which at least one pseudo-achromatic compensator(s) comprises first, second, third and forth Berek-type retarders which each have an optical axes essentially perpendicular to a surface thereof, each of which first and second Berek-type retarders has a fast axis, said fast axes in said first and second Berek-type retarders being oriented essentially parallel to one another; said first and second Berek-type retarders each presenting with first and second essentially parallel sides, and said first and second Berek-type retarders being oriented, as viewed in side elevation, with first and second sides of one Berek-type retarder being oriented other than parallel to first and second sides of the other Berek-type retarder; such that in use an incident beam of electromagnetic radiation is caused to impinge upon one of said first and second Berek-type retarders on one side thereof, partially transmit therethrough then impinge upon the second Berek-type retarder, on one side thereof, and partially transmit therethrough such that a polarized beam of electromagnetic radiation passing through both of said first and second Berek-type retarders emerges from the second thereof in a polarized state with a phase angle between orthogonal components therein which is different than that in the incident beam of electromagnetic radiation, and in a propagation direction which

is essentially undeviated and undisplaced from the incident beam of electromagnetic radiation; each of which third and forth Berek-type retarders has a fast axis, said fast axes in said third and forth Berek-type retarders being oriented essentially parallel to one another but other than parallel to the fast axes of said first and second Berek-type retarders, said third and forth Berek-type retarders each presenting with first and second essentially parallel sides, and said third and forth Berek-type retarders being oriented, as viewed in side elevation, with first and second sides of one of said third and forth Berek-type retarders being oriented other than parallel to first and second sides of said forth Berek-type retarder; such that in use an incident beam of electromagnetic radiation exiting said second Berek-type retarder is caused to impinge upon said third Berek-type retarder on one side thereof, partially transmit therethrough then impinge upon said forth Berek-type retarder on one side thereof, and partially transmit therethrough such that a polarized beam of electromagnetic radiation passing through said first, second, third and forth Berek-type retarders emerges from the forth thereof in a polarized state with a phase angle between orthogonal components therein which is different than that in the incident beam of electromagnetic radiation caused to impinge upon the first side of said first Berek-type retarder, and in a direction which is essentially undeviated and undisplaced from said incident beam of electromagnetic radiation; with a result being that retardation is entered between orthogonal components of said input electromagnetic beam of radiation.

43. A spectroscopic ellipsometer or polarimeter system comprising a source of a polychromatic beam of electromagnetic radiation, a polarizer, a stage for supporting a material system, an analyzer, a dispersive optics and at least one detector system which comprises a multiplicity of detector elements arranged in a

selection from the group consisting of:

one-dimensional; and
multi-dimensional;

array, such that when said spectroscopic ellipsometer or polarimeter is used to investigate a material system present on said stage for supporting a material system, a polychromatic beam of electromagnetic radiation produced by said source of a polychromatic beam of electromagnetic radiation is caused to pass through said polarizer, interact with a material system on said stage for supporting a material system, pass through said analyzer and interact with said dispersive optics such that a multiplicity of essentially single wavelengths are caused to simultaneously enter a corresponding multiplicity of detector elements in said at least one detector system;

said spectroscopic ellipsometer or polarimeter system further comprising an environmental control chamber in which the spectroscopic ellipsometer or polarimeter is contained, said environmental control chamber being characterized by a selection from the group consisting of:

it comprises at least one chamber region in which is present polarization state generator comprising component(s) prior to said material system, said material system, and polarization state detector comprising component(s) after said material system;

it comprises at least three chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, in the second of which is present the material system and in the third of which is present polarization state detector comprising

component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system and said material system, and in the second of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, and in the second of which is present polarization state detector comprising component(s) after said material system and said material system.

44. A spectroscopic ellipsometer or polarimeter system as in Claim 44 in which the multiplicity of detector elements are arranged in a one-dimensional array.

45. A spectroscopic ellipsometer or polarimeter system as in Claim 44 in which the multiplicity of detector elements are arranged in a two-dimensional array.

46. A spectroscopic ellipsometer or polarimeter system as in Claim 44 which further comprises at least one pseudo-achromatic compensator(s) positioned at a location selected from the group consisting of:

before said stage for supporting a material system;

after said stage for supporting a material system; and

both before and after said stage for supporting a material system.

47. A method of quickly simultaneously taking data at a multiplicity of wavelengths including wavelengths which are, and are not absorbed by environmental components, comprising the steps of:

a) providing a spectroscopic ellipsometer or polarimeter system comprising a source of a polychromatic beam of electromagnetic radiation, a polarizer, a stage for supporting a material system, an analyzer, a dispersive optics and at least one detector system which comprises a multiplicity of detector elements;

such that when said spectroscopic ellipsometer or polarimeter is used to investigate a material system present on said stage for supporting a material system, a polychromatic beam of electromagnetic radiation produced by said source of a polychromatic beam of electromagnetic radiation is caused to pass through said polarizer and interact with a material system on said stage for supporting a material system, then pass through said analyzer, and interact with said dispersive optics such that a multiplicity of essentially single wavelengths are caused to simultaneously enter a corresponding multiplicity of detector elements in said at least one detector system;

said spectroscopic ellipsometer or polarimeter system further comprising an environmental control chamber in which the spectroscopic ellipsometer or polarimeter is contained, said environmental control chamber being characterized by a selection from the group consisting of:

it comprises at least one chamber region in which is present polarization state generator comprising component(s) prior to said material system, said material system, and polarization state detector comprising component(s) after said material system;

it comprises at least three chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, in the second of which is present the material system and in the third of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system and said material system, and in the second of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, and in the second of which is present polarization state detector comprising component(s) after said material system and said material system.

b) placing a material system on said stage for supporting a material system and at least partially purging or evacuating said environmental control chamber;

c) causing said source of polychromatic beam of electromagnetic radiation to provide a polychromatic beam of electromagnetic radiation and causing said beam to interact with said material system on said stage for supporting a material system, and interact with said dispersive optics such that a multiplicity of

essentially single wavelengths are caused to simultaneously enter a corresponding multiplicity of detector elements in said at least one detector system.

48. A method of quickly simultaneously taking data at a multiplicity of wavelengths as in Claim 47 in which the step of providing at least one detector system which comprises a multiplicity of detector elements involves providing a one-dimensional array.

49. A method of quickly simultaneously taking data at a multiplicity of wavelengths as in Claim 47 in which the step of providing at least one detector system which comprises a multiplicity of detector elements involves providing a two-dimensional array.

50. A spectroscopic rotating compensator material system investigation system comprising a source of an polychromatic beam of electromagnetic radiation, a polarizer, a stage for supporting a material system, an analyzer, a dispersive optics and at least one detector system which comprises a multiplicity of detector elements, said spectroscopic rotating compensator material system investigation system further comprising at least one compensator(s) positioned at a location selected from the group consisting of:

before said stage for supporting a material system;

after said stage for supporting a material system; and

both before and after said stage for

supporting a material system;

such that when said spectroscopic rotating compensator material system investigation system is used to investigate a material system present on said stage for supporting a material system, said analyzer and polarizer are maintained essentially fixed in position and at least one of said at least one compensator(s) is caused to continuously rotate while a polychromatic beam of electromagnetic radiation produced by said source of a polychromatic beam of electromagnetic radiation is caused to pass through said polarizer and said at least one compensator(s), said polychromatic beam of electromagnetic radiation being also caused to interact with a material system on said stage for supporting a material system, pass through said analyzer and interact with said dispersive optics such that a multiplicity of essentially single wavelengths are caused to simultaneously enter a corresponding multiplicity of detector elements in said at least one detector system;

said spectroscopic rotating compensator material system investigation system further comprising an environmental control chamber in which said spectroscopic rotating compensator material system investigation system is contained, said environmental control chamber being characterized by a selection from the group consisting of:

it comprises at least one chamber region in which is present polarization state generator comprising component(s) prior to said material system, said material system, and polarization state detector comprising component(s) after said material system;

it comprises at least thr e chamber regions, in one of which is present polarization state generator comprising

component(s) prior to said material system, in the second of which is present the material system and in the third of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system and said material system, and in the second of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, and in the second of which is present polarization state detector comprising component(s) after said material system and said material system.

51. A spectroscopic ellipsometer or polarimeter system as in Claim 50 in which the multiplicity of detector elements are arranged in a one-dimensional array.

52. A spectroscopic ellipsometer or polarimeter system as in Claim 50 in which the multiplicity of detector elements are arranged in a two or three-dimensional array.

53. A spectroscopic rotating compensator material system investigation system comprising a source of an polychromatic beam of electromagnetic radiation, a polarizer, a stage for supporting a material system, an analyzer, a dispersive optics and at least one detector system which comprises a multiplicity of detector

elements, said spectroscopic rotating compensator material system investigation system further comprising at least one compensator(s) positioned at a location selected from the group consisting of:

before said stage for supporting a material system;

after said stage for supporting a material system; and

both before and after said stage for supporting a material system;

such that when said spectroscopic rotating compensator material system investigation system is used to investigate a material system present on said stage for supporting a material system at least one of said at least one compensator(s) is caused to continuously rotate while a polychromatic beam of electromagnetic radiation produced by said source of a polychromatic beam of electromagnetic radiation is caused to pass through said polarizer and said at least one compensator(s), said polychromatic beam of electromagnetic radiation being also caused to interact with a material system on said stage for supporting a material system, pass through said analyzer and interact with said dispersive optics such that a multiplicity of essentially single wavelengths are caused to simultaneously enter a corresponding multiplicity of detector elements in said at least one detector system;

said spectroscopic rotating compensator material system investigation system further comprising an environmental control chamber in which said spectroscopic rotating compensator material system investigation system is contained, said

environmental control chamber being characterized by a selection from the group consisting of:

it comprises at least one chamber region in which is present polarization state generator comprising component(s) prior to said material system, said material system, and polarization state detector comprising component(s) after said material system;

it comprises at least three chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, in the second of which is present the material system and in the third of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system and said material system, and in the second of which is present polarization state detector comprising component(s) after said material system;

it comprises at least two chamber regions, in one of which is present polarization state generator comprising component(s) prior to said material system, and in the second of which is present polarization state detector comprising component(s) after said material system and said material system.

54. A spectroscopic ellipsometer or polarimeter system as in Claim 53 in which the multiplicity of detector elements are arranged in a one-dimensional array.

55. A spectroscopic ellipsometer or polarimeter system as in Claim 53 in which the multiplicity of detector elements are arranged in a two or three-dimensional array.